

Action dated March 27, 2001. Claims 1-10 remain before the Examiner for reconsideration.

In the outstanding Office Action, the Examiner rejected Claims 1-10 under 35 U.S.C. Section 102(a or b) "as being anticipated by LeJeune et al (U),(V) or (W) or Havens et al. Specifically, the Examiner asserted that:

Specifically, the Examiner asserted that:

LeJeune et al (U), (V) or (W) or Havens et al. disclose immobilizing an enzyme in a polyurethane polymer by synthesizing the polymer in a reaction mixture containing the enzyme and a surfactant. Increase loading of enzyme in the polymer will be inherent.

Applicants respectfully traverse the Examiner's rejection.

Applicants are not claiming merely the addition of surfactant during the synthesis of a polymer immobilizing an enzyme, but including a sufficient amount of a surfactant in the reaction mixture to increase enzyme activity at an enzyme loading. Including a sufficient amount of a surfactant in the reaction mixture to increase enzyme activity at an enzyme loading is not disclosed or suggested in LeJeune et al. (U), (V) or (W) or Havens et al. Moreover, contrary to the Examiner's assertion, increased loading of enzyme in a polymer is not "inherent."

The use of surfactants during the immobilization of enzymes prior to the present invention (and as disclosed in LeJeune et al (U), (V), (W) and Havens et al.) is discussed on page 3 of the specification as follows:

Thus, recent studies of the synthesis of enzyme-containing polyurethanes have employed surfactants to alter/control the physical properties of the resultant polymers. For example, a number of studies describe the immobilization of organophosphorus hydrolase using a polyurethane polymer synthesis strategy in which a variety of non-ionic surfactants were used as additives to alter the physical properties polymers. Havens, P. L., Rase, H. F., Ind. Eng. Chem. Res., 32, 2254 (1993); LeJeune, K. E.,

Swers, J. S., Hetro, A. D., et al. *Biotechnol. Bioeng.*, 64, 2, 250 (1999); LeJeune, K. E., et al. *Biotechnol. Bioeng.*, 54, 105, (1997); LeJeune, K. E. and Russell, A. J. *Biotechnol. Bioeng.*, 51, 450 (1996). In general, these surfactants were used in an attempt to optimize the performance of the polyurethane sponge product in a particular application. For example, the studies of Havens and Rase were focused upon using the resultant polymers as column packing material and as adsorbent sponges to decontaminate pesticide spills. The studies reported varying surfactant hydrophobicity could produce polymers that were better suited for a particular application. The enzyme concentration/loading employed in the studies of Havens and Rase and the other studies was quite low (in general, well below 0.1 weight percent of the polymer).

LeJeune et al. (U), (V) or (W) or Havens et al. disclose merely the known use of surfactants to achieve desirable physical properties of an enzyme-containing polyurethane polymer. LeJeune et al. (U), (V) or (W) or Havens et al. do not disclose or suggest that surfactants, when used in sufficient amounts, increase enzyme activity as claimed in the present invention. Indeed, Applicants are the first to discover that surfactants can be used to increase enzyme activity at an enzyme loading. LeJeune et al. (U), (V) or (W) or Havens et al. thus do not and cannot anticipate the present invention.

The polymers and methods of the present invention provide enhanced enzyme activity retention as the enzyme loading or enzyme content of such polymers is increased beyond that of previous studies (for example, to above approximately 0.1 weight percent of the polymer). Through increased surfactant in the reaction mixtures of the present invention, relatively large quantities of enzymes are immobilized within the polymers of the present invention while retaining a significant portion of the native enzyme specific activity. The present invention thus provides a substantial improvement in the art.


An Information Disclosure Statement and copies of references cited therein accompanies this Response.

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In light of the above remarks, Applicants respectfully request that the Examiner withdraw his rejection of Claims 1-10, and that the Examiner indicate the allowability of Claims 1-10 and arrange for an official Notice of Allowance to be issued in due course.

Respectfully submitted,

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